CLAIMS

What is claimed is:

1. A method of detecting linear operation in a power amplifier, the power amplifier being operative to amplify an input signal for transmission, the method comprising the steps of:

detecting the output signal of the power amplifier;

converting the detected output signal into a digital signal;

examining the digital signal to determine the peak power represented by the digital signal;

examining the digital signal to determine the root-mean-square power of a portion of the digital signal;

decreasing the input power level of the input signal if the ratio of the peak power to the root-mean-square power below a first threshold level.

2. The method of claim 1, wherein the input signal is provided to the power amplifier through a variable gain amplifier, and the step of decreasing the input power level of the input signal comprises decreasing the gain of the variable gain amplifier.

3. The method of claim 1, further comprising the step of increasing the input power level of the input signal if the ratio of the peak power to the root-mean-square power is above a second threshold level.

4. The method of claim 1, further comprising the step of maintaining the input power level of the input signal if the ratio of the peak power to the root-mean-square power is between the second threshold level and the first threshold level.

5. The method of claim 1, wherein the step of examining the digital signal to determine the root-mean-square power of a portion of the digital signal further comprises identifying the mid-amble portion of the signal and determining the root-mean-square power of the mid-amble portion of the signal.

6. A circuit for maintaining linear operation of a power amplifier, the circuit comprising the components of:

a power amplifier, a variable gain amplifier, a coupler, a voltage detector, and a processor,

the power amplifier having a signal input and a signal output;

the variable gain amplifier having a signal input, a signal output, and a control input, the signal output of the variable gain amplifier being electrically coupled to the signal

input of the power amplifier, the signal input of the variable gain amplifier receiving a modulated signal that has been modulated with a base band signal, the control input of the variable gain amplifier being connected to a first control output of the processor,

the coupler being electrically coupled to the signal output of the power amplifier and operative, in cooperation with the voltage detector, to detect the envelope of an output signal at the signal output of the power amplifier and provide the detected envelope to a detected signal input of the processor;

the processor, being operative to:

receive the detected signal and determine the peak power of the detected signal and the root-mean-square power of at least a portion of the detected signal; and

adjust the first control output of the processor to limit the gain of the variable gain amplifier if the ratio of the peak power to the root-mean-square power is below a first threshold level.

7. The circuit of claim 6, wherein if the ratio of the peak power to the root-mean-square power is above a second threshold level, the processor is further operative to adjust the first control output of the processor to increase the gain of the variable gain amplifier if the output power is less than the target power level.

8. The circuit of claim 7, wherein if the ratio of the peak power to the root-mean-square power is between the first threshold level and the second threshold level, the processor is further operative to maintain the value of the first control output of the processor and thereby maintain the gain of the variable gain amplifier.

9. The circuit of claim 6, wherein if the ratio of the peak power to the root-mean-square power is below the second threshold level, the processor is further operative to maintain the value of the first control output of the processor and thereby maintain the gain of the variable gain amplifier.

10. The circuit of claim 6, wherein the power amplifier further includes a control input and the processor further includes a second control output that is electrically coupled to the control input of the power amplifier and, if the ratio is below the first threshold level, the processor is further operative to adjust the second control output to improve the linearity of the power amplifier and, if the ratio is above a second threshold level, to adjust the second control output to improve the efficiency of the power amplifier.

11. A mobile station for use in a cellular system, the mobile station comprising:

a power amplifier having a signal input received from a variable gain amplifier and a signal output for transmitting through an antenna;

a voltage detector coupled to the output of the power amplifier for detecting the output signal and obtaining a detected signal output;

an analog to digital converter electrically coupled to the output of the voltage detector for receiving the detected signal and for converting the detected signal from analog to a digital signal and providing the digital signal to a digital output;

a processor coupled to output of the analog to digital converter for receiving the digital signal, the processor being operative to:

determine the peak power of the digital signal;

determine the root-mean-square power of at least a portion of the digital signal;

determine the ratio of the peak power to the root-mean-square power; and

adjust the gain of the variable gain amplifier in accordance with the value of the ratio.

12. The mobile station of claim 11, wherein the processor is operative to adjust the gain of the variable gain amplifier by decreasing the gain if the ratio is below a minimum threshold.

13. The mobile station of claim 12, wherein the processor is further operative to adjust the gain of the variable gain amplifier by increasing the gain if the ratio is above a maximum threshold difference.

14. The mobile station of claim 13, wherein the processor is further operative to maintain the gain of the variable gain amplifier if the ratio is between the minimum threshold and the maximum threshold difference.

15. The mobile station of claim 14, wherein the processor is operative to determine the root-mean-square of the digital signal by detecting the synchronization bit sequence within the digital signal and determining the root-mean-square power of the synchronization bit sequence.

16. The mobile station of claim 14, wherein the processor is operative to determine the root-mean-square of the digital signal by detecting the mid-amble of the digital signal and determining the root-mean-square power of the mid-amble.

17. The mobile station of claim 11, further comprising a temperature sensor and, the processor is further operative to adjust the gain of the variable gain amplifier in accordance with the value of the ratio and the temperature reading of the sensor.

18. The mobile station of claim 11, further comprising a voltage sensor for measuring the voltage level of a source providing power to the mobile station and, the processor is further operative to adjust the gain of the variable gain amplifier in accordance with the value of the ratio and the level reading of the voltage sensor.

19. The mobile station of claim 11, further comprising a reverse power detector for detecting a voltage standing wave ratio and, the processor is further operative to adjust the gain of the variable gain amplifier in accordance with the value of the ratio of the peak power to the root-mean-square power and the voltage standing wave ratio.

20. The mobile station of claim 11, further comprising:

a temperature sensor and,

a voltage sensor for measuring the voltage level of a source providing power to the mobile station; and

the processor is further operative to adjust the gain of the variable gain amplifier in accordance with the value of the ratio of the peak power to the root-mean-square power and the temperature reading of the sensor and the level reading of the voltage sensor.